

Marine Conservation Enhancement Fund (MCEF)

Completion Report

Report for the period ending 31 October 2023

1. Executive Summary

Throughout 24 months from 1 November 2021 to 31 October 2023, the project entitled “Small players reveal crucial ecological mystery: Parasites as indicators of population ecology of endangered Indo-Pacific finless porpoises in HK waters” has been ongoing and the 3 objectives have been accomplished as elaborated below:

- (1) To recognise the identity and incidence of the parasite species of Indo-Pacific finless porpoises in HK waters

During the project period, 40 out of 42 Indo-Pacific finless porpoises (NP) stranded in HK waters were retrieved for postmortem investigation, including virtopsy (postmortem computed tomography, PMCT) and conventional necropsy. Evidence of parasitic infections was investigated in different body regions, in particular the peribullary sinuses, the respiratory system, and the reproductive organs, using radiological, morphological, and molecular approaches. In addition, retrospective virtopsy data of 153 retrospective cases from 2014 to the end of the project was reviewed with particular focus on the radiological detection of parasitic infections in the respiratory system and the reproductive organs. Using the virtopsy approach, prevalence of parasitic infections in the respiratory system and reproductive organs were evaluated as 83% and 50% respectively. The gross and microscopic appearances of different parasite species were also documented for future references.

- (2) To assess the impact of parasites on the natural mortality of Indo-Pacific finless porpoises in HK waters

In light of the high prevalence of severe parasitic pneumonia as the major cause of death in younger NP, 13 of such cases were selected, among which 5 cases with minimal postmortem changes in the lungs were further investigated. Lethal pathological features associated with *Halocercus pingi* infection, including bilateral reddening with focal areas of white to creamy discoloration, bronchointerstitial pneumonia, destructive emphysema, pulmonary abscesses, and liquefaction of consolidated lung tissues, were documented. The combination of multidisciplinary datasets supplemented the knowledge gap on parasites as a threat to the health status of NP and their long-term population ecology, and significantly facilitated the assessment on parasitic infections and related pathologies in future stranding investigation, allowing corrective assessment on the natural mortality in stranded NP and potentially other cetacean species in HK waters.

- (3) To evaluate parasites as biological indicators for stock identity and genealogy distribution of Indo-Pacific finless porpoises in HK waters

DNA was extracted from parasites isolated from the cranial sinuses, respiratory system, and reproductive organs of NP for phylogenetic analysis using the *COI* and *ITS-2* sequences. The result showed no clear separation of stocks of populations among the sample sets. The insignificant segregation could be explained by overlapping range of NP or broad distribution of parasites in the

HK waters studied. Despite the unsettled findings, the use of other high resolution neutral markers of loci could be explored in future.

This project aimed at gathering baseline data on the parasite spectrum and examining the impact of different parasite species on the health status of NP in HK waters. Additionally, it intended to gain insights into the evaluation of parasites as biological indicators for stock identity and genealogy distribution of NP in HK waters by combining methods from traditional parasitology with DNA technology. Most NP investigated in this project were parasitised by several parasite species in different organ systems simultaneously. Most species were endoparasites and the majority belonged to the phylum of Nematoda. Information was presented on parasite species, incidences, and associated diseases in NP, as well as the impact of parasites, in particular severe parasitic pneumonia as the major cause of death in younger NP, on the natural mortality of NP in HK waters for the first time. With the presence of another local resident cetacean species, the Indo-Pacific humpback dolphins, *Sousa chinensis*, which is facing multiple identical natural and anthropogenic impacts to NP. Taxonomically related hosts are generally more prone to infections by the same parasite species spectrum. However, even closely related host species are not necessarily infected with the same parasite species, prevalence and intensity nor show the same pathologies when infected by the same parasite species. Further interspecies comparative studies on the parasite fauna and their prevalence in both resident cetacean species in HK waters are suggested to evaluate the host specificities of different parasites and their corresponding health impacts in the future.

In this project, the occurrence and high prevalence of *Halocercus sunameri* only in older individuals suggested its transmission pathway related to prey feeding upon maturation. A variety of factors mediate the compatibility of hosts and parasites, including ecology, physiology, immunity and genetics, which can vary between related species. Many aspects of the biology of NP parasites, including their intermediate hosts and life cycles, are poorly studied if not completely unknown and had not been covered in this project scope. Future studies need to incorporate information of the life cycles of the identified parasites, which should allow a more detailed view of the underlying transmission patterns and thus, facilitate the development of epidemiological models for the understanding of their population-level consequences.

Besides, phylogenetic trees were constructed based on *COI* and *ITS-2* sequences of parasites isolated from cranial sinuses, respiratory system, and reproductive organs, though no clear separation of stocks of populations among the sample sets were shown. The findings hinted that these NP parasite species had adapted to the highly vagile lifestyle of their oceanic hosts in this coastal environment in HK waters. The HK waters is just part of the home range of NP, the population dynamics of NP in the Pearl River Estuary region should be considered as a whole at a greater extent. The stock identity and genealogy distribution of NP around HK and adjacent waters, i.e. Guangdong-Hong Kong-Macao Greater Bay Area and southern coast of China and their phylogeography are suggested to be investigated further with collaborative efforts among stranding networks in these regions.

Nevertheless, with the support of the Marine Conservation Enhancement Fund on this first-of-this-kind NP parasitology project, new baseline data and diagnostic references of commonly encountered parasite species infecting NP were collected, and the understanding of their importance for the health of these animals was largely improved.